different spectra, inasmuch as their absorption-bands vary in position and in intensity.

(3.) The photographic absorption spectra can be employed as a means of identifying organic substances, and as a most delicate test of their purity. The curves obtained by co-ordinating the extent of dilution with the position of the rays of the spectrum absorbed by the solution form a strongly marked and often a highly characteristic feature of many organic compounds.

There is a curious feature in connexion with the position of the absorption bands; at the less refrangible end they either begin at line 12 Cd or line 17 Cd, and those which begin at 12 end a little beyond 17.

No naphthalene or anthracene derivatives have yet been examined, and very few substances of unknown constitution—hence most interesting results may be anticipated from a continuation of this research, and this contribution must be accepted rather as a bare commencement of the subject than its conclusion.

II. "On the Electromagnetic Theory of the Reflection and Refraction of Light." By George Francis Fitzgerald, M.A., Fellow of Trinity College, Dublin. Communicated by G. J. Stoney, M.A., F.R.S., Secretary of the Queen's University, Ireland. Received October 26, 1878.

(Abstract.)

The media, at whose surfaces reflection and refraction are supposed to take place, are assumed to be non-conductors, and isotropic as regards magnetic inductive capacity. Some reasons are advanced why the results should apply at least approximately to conductors. In the first part of the paper the media are not assumed to be isotropic as regards electrostatic inductive capacity, so that the results are generally applicable to reflection and refraction at the surfaces of crystals. I use the expressions given by Professor J. Clerk Maxwell in his "Electricity and Magnetism," vol. ii, Part IV, chap. 11, for the electrostatic and electrokinetic energy of such media. By assuming three quantities, ξ, η, and ζ, such that, t representing time, $\frac{d\xi}{dt}$, $\frac{d\eta}{dt}$, and $\frac{d\zeta}{dt}$, are the components of the magnetic force at any point, I have thrown these expressions for the electrostatic and electrokinetic energy of a medium into the same forms as M'Cullagh assumed to represent the potential and kinetic energy of the ether, in "An Essay towards a Dynamical Theory of Crystalline Reflection and Refraction," pub-

lished in vol. xxi of the "Transactions of the Royal Irish Academy." Following a slightly different line from his, I obtain, by a quaternion and accompanying Cartesian analysis, the same results as to wave propagation, reflection, and refraction, as those obtained by M'Cullagh, and which he developed into the beautiful theorem of the polar plane. Of course, the resulting laws of wave propagation agree with those obtained by Professor Maxwell from the same equations by a somewhat different method. For isotropic media, the ordinary laws of reflection and refraction are obtained, and the well-known expressions for the amplitudes of the reflected and refracted rays.

In the second part of the paper I consider the case of reflection at the surface of a magnetised medium, adopting the expressions Professor J. Clerk Maxwell has assumed in "Electricity and Magnetism," vol. ii, Part IV, § 824, to express the kinetic energy of such a medium. From this, following the same line as before, I have deduced the following equations to represent the superficial conditions: In them, ξ, η, ζ, have the same meaning as before, and the axes are x in the intersections of the plane of incidence and the surface, y in the surface, and z normal to it; α, β, γ, are the components of the strength of the vortex that Professor Maxwell assumes, and $\frac{d}{dh}=\alpha\frac{d}{dx}+\beta\frac{d}{dy}+\gamma\frac{d}{dz}$, which, with these axes, reduces to $\alpha\frac{d}{dx}+\gamma\frac{d}{dz}$; K and K_1 are the electrostatic inductive capacities of the two media in contact, and the quantities referring to one of these which is supposed to be non-magnetic are distinguished by the suffix $_1$; C is a constant, on which the power of the medium to rotate the plane of polarisation of light depends.

$$\frac{d\xi_1}{dz_1}-\frac{d\zeta_1}{dx_1}=\frac{K_1}{K}\left(\frac{d\xi}{dz}-\frac{d\zeta}{dx}\right)-4\pi CK_1\left\{\gamma\frac{d^2\eta}{dzdt}+\frac{d^2\eta}{dhdt}\right\}$$

$$\frac{d\eta_1}{dz_1}=\frac{K_1}{K}\cdot\frac{d\eta}{dz}+4\pi CK_1\left\{\gamma\frac{d}{dt}\left(\frac{d\xi}{dz}-\frac{d\zeta}{dx}\right)+\frac{d^2\xi}{dhdt}\right\}.$$

As these are unchanged by a simultaneous alteration of the signs of η and C, I show that the method adopted in my former paper on Magnetic Reflection in the "Proceedings of the Royal Society," for 1876, No. 176, is justified, and that it is legitimate to consider an incident plane polarised ray as composed of two oppositely circularly polarised rays, each of which is reflected according to its own laws. From these I further deduce that, when the magnetisation of the medium is all in the direction of η, there is no effect on reflection or refraction produced by it. I consider next the cases of the magnetisation being all normal to the surface, and all in the surface and the plane of incidence, and obtain the following result: When the incident ray is plane polarised, and the plane of polarisation is either in or

perpendicular to the plane of incidence, the effect of magnetisation is to introduce a component into the reflected ray perpendicular to the original plane of polarisation, whose amplitude, c, is given in the several cases by the following equations, in which i is the angle of incidence, and r of reflection, and k a small constant depending principally on C, and the intensity of the incident ray:—1. When the magnetisation is normal to the reflecting surface. If the incident ray be polarised in the plane of incidence—

$$c=k\,.\,\frac{(1+\cos^2 r)\sin^2 i\sin 2i}{\sin r\,.\,\sin^2(i+r)\,.\,\cos(i-r)}.$$

If it be polarised in a plane perpendicular to the plane of incidence—

$$c=k\frac{\cos^2 r\,.\,\sin^2 i\sin 2i}{\sin r\,.\,\sin^2(i+r)\,.\,\cos(i-r)}.$$

2. When the magnetisation is parallel to the intersection of the surface and the plane of incidence, and the plane of polarisation of the incident ray is either in or perpendicular to the plane of incidence—

$$c=k\frac{\cos r\sin^2 i\sin 2i}{\sin^2(i+r)\cos(i-r)}.$$

This vanishes at the grazing and normal incidences, and, in the case of iron, attains a maximum at about the angle of incidence $i=63^\circ\ 20'$.

I do not obtain any change of phase by reflection in any case; and this is to be expected, as this change of phase probably depends on the nature of the change from one medium to another, which, following M'Cullagh, I have uniformly assumed to be abrupt. Apart from this question of change of phase, my results conform completely to Mr. Kerr's beautiful experiments on the reflection of light from the pole of a magnet, as published in the Philosophical Magazines for May, 1877, and March, 1878.

III. "On Dry Fog." By E. Frankland, D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines. Received October 29, 1878.

It has often been noticed, especially in and near large towns, that a foggy atmosphere is not always saturated with moisture: thus on the 17th of October last, at 3·30 p.m., during a thick fog in London, the degree of humidity was only 80 per cent. of saturation; and Mr. Glaisher, in his memorable balloon ascents, observed that in passing through cloud or fog the hygrometer sometimes showed the air to possess considerable dryness. In the ascent from Wolver-